

dado que se han observado cópulas extra-pareja en la población estudiada.

[Traducción Autor]

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#### LITERATURE CITED

- ARROYO, B.E. 1995. Breeding ecology and nest dispersion of Montagu's harrier *Circus pygargus* in central Spain. Ph.D. dissertation, Oxford University, Oxford, U.K.
- BEDNARZ, J.C. 1987. Pair and group reproductive success, polyandry and cooperative breeding in Harris' hawk. *Auk* 104(3):393-404.
- BERG, G. 1988. Trios in the golden eagle *Aquila chrysaetos* (L.). *Fauna Norv. Ser. C* 11(1):40-44.
- CORMIER, J.R. 1990. Un cas d'aide á l'élevage des jeunes de la part d'un mâle de deux aus chez le busard cendré *Circus pygargus* (L.). *Alauda* 58(3):203-204.
- CRAMP, S., AND K.E.L. SIMMONS [EDS.]. 1980. The birds of the western Palearctic, Vol. 2. Oxford Univ. Press, Oxford, U.K.
- DAY, J. 1990. The status and breeding biology of marsh harrier and Montagu's harrier in Britain since 1900. Ph.D. dissertation, CNA A, London, U.K.
- FAABORG, J., T. DE VRIES, C.B. PATTERSON AND C.R. GRIFFIN. 1980. Preliminary observations on the occurrence and evolution of polyandry in the Galapagos hawk (*Buteo galapagoensis*). *Auk* 97(3):581-590.
- HAMERSTROM, F. 1969. A harrier population study. Pages 367-383 in J.J. Hickey [Ed.] Peregrine falcon populations: their biology and decline. Univ. Wisconsin Press, Madison, WI U.S.A.
- HEREDIA, R. AND J.A. DONÁZAR. 1990. High frequency of polyandrous trios in an endangered population of Lammergeiers *Gypaetus barbatus* in northern Spain. *Biol. Conserv.* 53(3):163-171.
- NEWTON, I. 1979. Population ecology of raptors. T. & A.D. Poyser, Calton, U.K.
- PACKHAM, C. 1985. Bigamy in the kestrel. *Brit. Birds* 78(4):194.
- TELLA, J.L. 1993. Polyandrous trios in a population of Egyptian vultures (*Neophron percnopterus*). *J. Raptor Res.* 27:119-120.
- THOMSETT, S. 1991. Polyandrous pigmy falcons? *GABAR* 6(2):73.

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### NOTES ON THE DIET OF SHORT-EARED OWLS (*ASIO FLAMMEUS*) IN TEXAS

KELLY M. HOGAN, MORGAN L. HOGAN,<sup>1</sup> JENNIFER GABLE AND MARTIN BRAY

U.S. Fish and Wildlife Service, Lower Rio Grande National Wildlife Refuge, Rt. 2, Box 202A, Alamo TX 78516

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Although a common winter resident along the gulf coastal plain (Oberholser 1974, Rappole and Blacklock 1994), no information exists on the diet of short-eared owls (*Asio flammeus*) in Texas. This lack of information is in stark contrast to the plethora of dietary information for the species from other portions of its range (Tomkins 1936, Banfield 1947, Stegeman 1957, Munyer 1966, Clark 1975, Wiebe 1991, Rau et al. 1992, Holt 1993, Holt and Leasure 1993). Here we report the results of an analysis

of short-eared owl pellets collected in the Lower Rio Grande Valley, Texas.

Between 27 February and 3 March 1995, short-eared owl pellets were collected from the Marinoff Tract, Lower Rio Grande National Wildlife Refuge, Hidalgo County, Texas. As a result of activities associated with an ongoing vegetation study, roosting short-eared owls were flushed periodically allowing for the identification of roost sites and collection of pellets. Roost sites were located on the ground in grasslands dominated by dense stands of guinea grass (*Panicum maximum*) (Gould 1975) with a mean height of 60 cm. Pellets were collected daily from each roost site until abandoned by the owls.

Pellets were dissected and prey remains collected after submerging the pellets in a 1.0% (w/v) solution of sodium chloride. After approximately 10 min in the salt solution, pellets were teased apart and allowed to remain

<sup>1</sup> Texas Parks and Wildlife Department, Las Palomas Wildlife Management Area, 410 N. 13th Street, Edinburg TX 78539, U.S.A.

in solution for another 10 min. The floating material was then collected with a fine metal screen and the remaining liquid was poured through a fine net sieve. This process was repeated until all skeletal material was separated from the hair, feathers, or detritus in the pellets. The hair, feathers and skeletal material were then dried in a warm oven, and examined with the aid of a dissecting microscope.

Mammalian skull and dental remains found in pellets were identified using a skull key (Jones and Manning 1992). Avian remains were identified with the aid of comparative material in the Texas Cooperative Wildlife Collection at Texas A&M University. Insects were identified to order with the aid of an insect field guide (Borror and White 1970) and the reference collection at the Santa Ana National Wildlife Refuge. Estimates of biomass were calculated for each prey item identified to species level. Average mass estimates used to calculate biomass were derived from Lowery (1981) and Davis and Schmidly (1994).

Three roost sites were located during the course of this study. Since none of the owls flushed from these roosts were banded and/or color marked we could not determine conclusively the number of owls using each roost during the observation period. From these roost sites, a total of 48 short-eared owl pellets were collected. Based on the remains in each pellet, 38 prey items were identified. The majority of prey items, 29 (76.3%), were mammalian. Of the total prey remains found, the least shrew (*Cryptotis parva*) accounted for over half, 22 (57.9%), of the prey items observed. Additional mammal remains included three (7.9%) white-footed mice (*Peromyscus leucopus*), two (5.3%) hispid cotton rats (*Sigmodon hispidus*), one (2.6%) house mouse (*Mus musculus*), and one (2.6%) Mexican spiny mouse (*Liomys irroratus*). The remaining prey items included one (2.6%) unidentified Icteridae bird, and eight (21.1%) grasshoppers of the order Orthoptera.

In terms of biomass, hispid cotton rats contributed approximately half (44.5%) of the total followed by least shrews (25.6%), white-footed mice (15.4%), Mexican spiny mice (10.9%) and house mice (3.6%). The large contribution of cotton rats to total dietary biomass supports the inverse relationship between prey size and the total number of prey items per pellet (Weller et al. 1963) and may explain the low mean number of prey items per pellet observed in this study (0.792) relative to previous studies (Clark 1975, Wiebe 1991).

Our analysis provides two noteworthy observations regarding the diet of short-eared owls in Texas. The remains of least shrew and Mexican spiny mouse collected are the first reported occurrence of these species in the diet of short-eared owls. While our results support previous observations that mammals are the principle component in the diet of short-eared owls (Holt 1993, Holt and Leasure 1993), the large portion of shrews encountered differs from previous observations and suggests

that in areas devoid of microtines, shrews are an important food item.

The number of insects, especially grasshoppers, encountered in the pellets of these wintering short-eared owls was also of interest. Previous investigations of the food habitats of short-eared owls suggest that insects constitute a minor percentage of prey items taken by the owls (Wiebe 1991, Rau et al. 1992, Holt 1993, Holt and Leasure 1993). Because we were unable to identify the grasshopper remains to species, no attempt was made to quantify the contribution of the insects taken in terms of total dietary biomass. Our results suggest, however, that when present grasshoppers may contribute to the diet of wintering short-eared owls in south Texas.

RESUMEN.—Los restos de fauna obtenidos del análisis de 48 egagrópilas de *Asio flammeus* mostraron que la mayoría de las presas consumidas, 29 (76.3%), eran mamíferos. Del total, más de la mitad 22 (57.9%) correspondían a *Cryptotis parva*. Adicionales restos de mamíferos incluyeron tres *Peromyscus leucopus* (7.9%), dos *Sigmodon hispidus* (5.3%), un *Mus musculus* (2.6%) y un *Liomys irroratus*. Las categorías de presas restantes incluyeron un Icteridae (2.6%) y ocho saltamontes (21.8%) del orden Orthoptera. Nuestros resultados documentan la primera ocurrencia de *C. parva* y *L. irroratus* en la dieta de *A. flammeus* y sugieren que los saltamontes son más comunes en la dieta de lo que previamente ha sido reportado.

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#### LITERATURE CITED

- BANFIELD, A.W.F. 1947. A study of the winter feeding habits of the short-eared owl in the Toronto region. *Can. J. Res.* 25:45–65.
- BORROR, D.J. AND R.E. WHITE. 1970. A field guide to the insects. Houghton Mifflin Company, Boston, MA U.S.A.
- CLARK, R.J. 1975. A field study of the short-eared owl, *Asio flammeus* (Pontoppidan) in North America. *Wildl Monogr.* 47:1–67.
- DAVIS, W.B. AND D.J. SCHMIDLY. 1994. The mammals of Texas. Texas Parks and Wildlife Press, Austin, TX U.S.A.
- GOULD, F.W. 1975. The grasses of Texas. Texas A&M Univ. Press, College Station, TX U.S.A.
- HOLT, D.W. 1993. Breeding season diet of short-eared owls in Massachusetts. *Wilson Bull.* 105:490–496.
- AND S.M. LEASURE. 1993. Short-eared owl (*Asio flammeus*). In A. Poole and F. Gill [Eds.], *The birds of North America*, No. 62. The Academy of Natural Sci-

- ences, Philadelphia, and The American Ornithologists' Union, Washington, DC U.S.A.
- JONES, J.K. AND R.W. MANNING. 1992. Illustrated key to skulls of genera of North American land mammals. Texas Tech Univ. Press, Lubbock, TX U.S.A.
- LOWERY, G.H. 1981. The mammals of Louisiana and its adjacent waters. Louisiana State Univ. Press, Baton Rouge, LA U.S.A.
- MUNYER, E.A. 1966. Winter food of the short-eared owl in Illinois. *Ill. Acad. Sci.* 52:174–180.
- OBERHOLSER, H.C. 1974. The bird life of Texas. Univ. of Texas, Austin, TX U.S.A.
- RAPPOLE, J.H. AND G.W. BLACKLOCK. 1994. A field guide: birds of Texas. Texas A&M Univ. Press, College Station, TX U.S.A.
- RAU, J.R., M.C. VILLAGRA, M.L. MORA, D.R. MARTINEZ AND M.S. TILLERIA. 1992. Food habits of the short-eared owl (*Asio flammeus*) in southern South America. *J. Raptor Res.* 26:35–36.
- STEGEMAN, L.C. 1957. Winter food of the short-eared owl in central New York. *Am. Midl. Nat.* 57:120–124.
- TOMKINS, I.R. 1936. Notes on the winter food of the short-eared owl. *Wilson Bull.* 48:77–79.
- WELLER, M.W., L.H. FREDRICKSON AND F.W. KENT. 1963. Small mammal prey of some owls wintering in Iowa. *Wilson Bull.* 67:189–193.
- WIEBE, K.L. 1991. Food habits of breeding short-eared owls in southwestern British Columbia. *J. Raptor Res.* 25:143–145.

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